

Dietary Comparisons of Adult Male Common Grackles, Red-winged Blackbirds, and Yellow-headed Blackbirds in North Central North Dakota

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ABSTRACT - We compared the esophageal contents of adult male common grackles (*Quiscalus quiscula*), red-winged blackbirds (*Agelaius phoeniceus*), and yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) collected in north central North Dakota from July through October 1989. Temporal variation in the diets of all species was related to food availabilities, which were heavily influenced by crop phenology. Depending on species, mean percent dry weight of sunflower achenes during August increased 2-6 times over July. Yellow-headed blackbirds migrated from north central North Dakota by early September, but substantial numbers of common grackles and red-winged blackbirds remained until mid-October. Sunflower was an important component of red-winged blackbird and common grackle diets through October. The more varied diet of yellow-headed blackbirds, in combination with the early departure from sunflower-growing regions, makes this species less likely to cause economic impact to the sunflower producer.

Key words: *Agelaius phoeniceus*, food habits, North Dakota, *Quiscalus quiscula*, sunflower, *Xanthocephalus xanthocephalus*

Red-winged blackbirds (*Agelaius phoeniceus*), yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), and common grackles (*Quiscalus quiscula*) are the most abundant blackbird species (Icterinae) in North Dakota. Comparisons between breeding bird surveys made in 1967 and 1991 indicated that red-winged blackbirds decreased 68% to 1.4 million breeding pairs, whereas yellow-headed blackbirds increased 225% to 665,000 pairs and common grackles increased 105% to 698,000 pairs (Stewart and Kantrud 1972, Nelms 1991).

Blackbirds aggregate into large mixed-species flocks beginning in July and forage in habitats surrounding their wetland roosting sites until migration in September and October (Linz 1982). Economic losses to North Dakota sunflower

producers from foraging blackbirds were estimated at \$2 million annually from 1986 to 1991 (Huffman 1992). The birds apparently prefer sunflower achenes (sunflower) to other available foods because of the high energy content of sunflower and its availability near wetland roosting sites (Otis and Kilburn 1988).

Research on the food habits of male and female red-winged blackbirds, yellow-headed blackbirds, and common grackles has shown that male red-winged and yellow-headed blackbirds and both sexes of common grackles were primarily responsible for sunflower damage in North Dakota (Linz et al. 1983, 1984; Twedt et al. 1991; Homan et al. 1994). However, these studies were conducted in different areas of North Dakota and during different years. Thus, direct dietary comparisons among species were not possible.

We investigated the feeding habits of adult male red-winged blackbirds, yellow-headed blackbirds, and common grackles in Benson County, North Dakota, from 1 July to 25 October 1989. Our objectives were to compare the diets among the three species in crop and noncrop habitats and to analyze temporal dietary variation.

STUDY AREA

Benson County (area 364,900 ha) is located in north central North Dakota in the northeastern Drift Plain physiographic region (Stewart 1975). The terrain is flat to gently rolling and is primarily cropland interspersed with numerous shelterbelts and potholes.

Approximately 206,275 ha (56%) of Benson County were cultivated in 1989 (North Dakota Agricultural Statistics Service 1990); 66% of the cropped land was planted to small grains (wheat and barley). Sunflower, oats, and corn accounted for 10%, 4%, and 2% of the hectares, respectively. Minor crops (e.g., rye, flaxseed, edible beans, and soybeans) represented less than 3% of the hectares planted in 1989. Hay was grown on 12% of the cultivated land. The average annual precipitation is 43 cm, with the majority falling from April through September. In summer, the average temperature is 19° C. Average dates of first and last frosts (0° C) are 13 September and 23 May, respectively.

METHODS

Collecting and Processing

We collected adults of the three blackbird species by shotgun one to two times weekly in Benson County, North Dakota, from 1 July to 25 October 1989. To reduce the influence of time of collection and habitat, the birds were collected during all daylight hours wherever and whenever encountered. Additionally, we collected birds from flightlines in the late afternoon while they were going to roost. The birds were numbered, placed in plastic bags, and immediately packed in ice to retard post-mortem esophageal digestion of foods. We either processed the birds within four hours of collection or froze them for later processing.

Each bird was weighed and aged using a combination of plumage characteristics and the presence or absence of the bursa of Fabricius (Wright and Wright 1944). The food items were removed from the oral cavity and esophagus, including the proventriculus (Gartshore et al. 1979), placed in ethanol, and sorted as sunflower, corn, small grains (wheat, barley, oats), weed seeds [largely foxtail (*Setaria* spp.), wild oats (*Avena* spp.)], insects, grit, and unidentifiable matter (Homan et al. 1994). All foods were oven-dried at 70° C for 36–48 hr, air cooled, and weighed to the nearest 0.001 g on an electronic top-loading balance.

Statistical Analyses

Only birds containing one or more food item(s) were included in the analyses (Homan et al. 1994). Food items weighing less than 0.001 g were recorded as 0.001 g to indicate that food was present. After deriving the mean proportion esophageal dry weights of the individual food categories (Swanson et al. 1974), we omitted the corn and unidentifiable matter categories because of extremely low frequencies of occurrence. Grit was not included in the analyses.

We used multivariate analysis of variance (MANOVA) on square-root, arcsine-transformed mean proportions of esophageal dry weight (Zar 1984:239–240) to compare diets among habitats (sunflower and noncrop), species, and months. Low availabilities of yellow-headed blackbirds in Benson County in September and October precluded dietary analyses among the three species for these months; thus, only the diets of red-winged blackbirds and common grackles were compared during this time. In sunflower habitat, esophageal contents of the three species were analyzed only for August; we could not collect a large enough sample size to analyze all three species' diets in July.

F-statistics, based on Wilk's lambda, refer to simultaneous comparisons of all dietary categories (SAS Institute, Inc. 1988). Statistical significance was accepted at $P \leq 0.05$. Preliminary dietary analyses between birds from sunflower and noncrop habitats (shelterbelts, pastures, wetlands, and flightlines) revealed a habitat effect ($P < 0.0001$); thus, habitats were analyzed separately. Significant interactions ($P \leq 0.05$) occurred between species and months; therefore, diets were compared within months.

Food consumption is reported as mean percent dry weight and relative percent frequency of occurrence (Twedt et al. 1991, Homan et al. 1994). The mean percent dry weight for each food category is defined as the average of the dry weight proportions multiplied by 100 (Swanson et al. 1974). The relative percent frequency of occurrence is the number of times a food category occurs divided by the total number of times all food categories occur in all individuals multiplied by 100 (Twedt et al. 1991, Homan et al. 1994).

RESULTS

Noncrop Habitats

Esophageal contents differed among the three species for July ($F=2.54$; $df=8,102$; $P=0.01$) and August ($F=3.29$; $df=8,226$; $P=0.001$). In July, red-winged blackbirds consumed more sunflower and weed seeds but fewer insects than yellow-headed blackbirds (Table 1). Also in July, more insects were found in common grackles than in red-winged blackbirds. The esophageal contents of yellow-headed blackbirds and common grackles were similar during July, with insects comprising approximately 50% of both species' diets. In August, red-winged blackbirds contained fewer small grains and weed seeds and more sunflower than yellow-headed blackbirds, whereas common grackles consumed more sunflower and fewer weed seeds than yellow-headed blackbirds (Table 1). Red-winged blackbirds and common grackles had similar esophageal contents in August, when both species dramatically increased their use of sunflower. However, esophageal contents were different in September ($F=4.62$; $df=4,71$; $P=0.002$) and October ($F=20.68$; $df=4,67$; $P<0.0001$) between the two species. In September, more weed seeds were found in red-winged blackbirds than in common grackles (Table 1). In October, the differences in the diets of the two species were more pronounced, with red-winged blackbirds consuming fewer insects and small grains but more sunflower; weed seeds were not found in common grackles in October.

Sunflower Habitat

Common grackles and red-winged blackbirds consumed more sunflower and fewer weed seeds in August than yellow-headed blackbirds ($F=8.54$; $df=8,412$; $P<0.0001$). Common grackles and red-winged blackbirds had similar diets in August and concentrated on sunflower almost exclusively (Table 2). There was a significant difference in dietary intake in September, when common grackles consumed fewer weed seeds than red-winged blackbirds ($F=3.19$; $df=4,226$; $P=0.01$), but sunflower consumption by both species still remained high. In October, red-winged blackbirds displayed a more varied diet than common grackles, who relied almost completely on sunflower (Table 2); during October, red-winged blackbirds ate less sunflower but more insects and weed seeds than common grackles ($F=11.04$; $df=4,54$; $P<0.0001$).

DISCUSSION

We compared the esophageal contents of adult male red-winged blackbirds, yellow-headed blackbirds, and common grackles collected in the same locale during the same time period. Variation in the males' diets was similar to that found in studies conducted elsewhere in North Dakota that focused on sex differences in red-winged blackbirds (Linz et al. 1983, 1984), yellow-headed blackbirds (Twedt et al. 1991), and common grackles (Homan et al. 1994). Temporal variation in the

Table 1. Monthly comparisons of mean percent dry weight^a (relative percent frequency of occurrence^b) of esophageal food contents of male red-winged blackbirds (Ap), common grackles (Qq), and yellow-headed blackbirds (Xx) collected in noncrop habitats^c in Benson County, North Dakota, in 1989.

Foods	Month											
	July			August			September			October		
	Ap n = 19	Qq n = 10	Xx n = 28	Ap n = 69	Qq n = 16	Xx n = 34	Ap n = 46	Qq n = 30	Ap n = 55	Qq n = 17		
Sunflower	33 (26)	10 (10)	4 (4)	67 (47)	52 (48)	24 (16)	55 (30)	42 (39)	89 (51)	44 (33)		
Small grains ^d	10 (6)	20 (20)	29 (22)	17 (15)	35 (32)	46 (26)	35 (22)	47 (36)	1 (1)	52 (42)		
Weed seeds ^e	41 (36)	20 (20)	18 (18)	11 (18)	6 (10)	26 (29)	8 (20)	tr ^f (2)	10 (40)	0 (0)		
Insects	16 (32)	50 (50)	49 (56)	5 (20)	7 (10)	4 (29)	2 (28)	11 (23)	tr (8)	4 (25)		

^aMean percent dry weight = weight of food + weight of all food categories determined for each bird, then averaged over all birds and multiplied by 100.

^bRelative percent frequency of occurrence = number of birds containing a food item + the total number of occurrences of all food items in all birds and multiplied by 100.

^cShelterbelts, wetlands, pastures and woodlands.

^dWheat, barley and oats.

^ePrimarily foxtail (*Setaria* spp.) and wild oats (*Avena* spp.).

^ftr = <0.5%.

Table 2. Monthly comparisons of mean percent dry weight^a (relative percent frequency of occurrence^b) of esophageal food contents of male red-winged blackbirds (Ap), common grackles (Qq), and yellow-headed blackbirds (Xx) collected in sunflower fields in Benson County, North Dakota, in 1989.

	Month						
	August			September		October	
	Ap n = 130	Qq n = 19	Xx n = 63	Ap n = 118	Qq n = 113	Ap n = 44	Qq n = 30
Foods							
Sunflower	92 (68)	98 (86)	62 (43)	93 (53)	94 (74)	67 (36)	100(94)
Small grains ^c	2 (2)	0 (0)	1 (1)	2 (3)	3 (5)	1 (4)	0 (0)
Weed seeds ^d	4 (10)	0 (0)	36 (33)	3 (16)	1 (5)	30 (32)	0 (0)
Insects	2 (20)	2 (14)	1 (23)	2 (28)	2 (16)	2 (28)	tr ^e (6)

^aMean percent dry weight = weight of food ÷ weight of all food categories determined for each bird, then averaged over all birds and multiplied by 100.

^bRelative percent frequency of occurrence = the number of birds containing a food item ÷ the total number of occurrences of all food items in all birds and multiplied by 100.

^cWheat, barley and oats.

^dPrimarily foxtail (*Setaria* spp.) and wild oats (*Avena* spp.).

^etr = <0.5%.

diets was related to food availabilities, which in turn were heavily influenced by crop phenology (Twedt et al. 1991, Homan et al. 1994).

In addition to the influences exerted by crop maturation, the habitats in which the birds were collected contributed significantly to dietary variation. Because of this habitat effect, we conducted dietary analyses separately between sunflower and noncrop habitats.

Noncrop Habitats

Blackbird damage to sunflower is greatest in August (Cummings et al. 1989), when sunflower is in the "milk stage" of development. In August, yellow-headed blackbirds used small grains, weed seeds, and sunflower in decreasing order of importance. They consumed sunflower in proportions less than half that of common grackles or red-winged blackbirds collected during the same period. Yellow-headed blackbirds usually migrate from north central North Dakota by early September (Twedt et al. 1991), before common grackles and red-winged blackbirds. The latter two species will often feed in sunflower until migration in late September and October. The migratory timing and diet of yellow-headed blackbirds make them less likely to cause a significant economic impact to sunflower producers in North Dakota.

Considering the availabilities of crops in the county, the birds were utilizing sunflower (10% of the cropped land) over small grains (67% of the cropped land). Small grains were an important food for blackbirds from July through October.

However, most small grains consumed after July were probably waste grains from harvested fields.

Relative percent frequencies of occurrence for insects and weed seeds demonstrated that they were important dietary items for all three blackbird species (Table 1). The departure between the August values for relative percent frequency of occurrence and mean percent dry weight reflects the increasing availabilities of sunflower and small grains due to crop maturation. Both of these foods have heavier per unit weights than either weed seeds or insects. The mean percent dry weight value probably underestimates the dietary importance of weed seeds and insects.

Cattail-dominated wetlands are often used by red-winged blackbirds as roosting and loafing sites, with small wetlands adjacent to sunflower appearing to be particularly attractive. Sunflower losses can be extensive near these wetlands (Otis and Kilburn 1988). Red-winged blackbirds were often encountered and collected while loafing in small (less than 1 ha) cattail-dominated wetlands adjacent to sunflower. Common grackles were usually collected in more upland-type habitats, such as shelterbelts, pastures, and harvested grain fields. This difference in diurnal habitat use between the two species probably accounts for some of the dietary variation in October, when red-winged blackbirds collected in noncrop habitats contained 89% sunflower compared to 44% for common grackles.

There appears to be only small between-year dietary variation in consumption of sunflower for adult male red-winged blackbirds in North Dakota. During August, estimates of sunflower consumption by red-winged blackbirds collected in noncrop habitats was 67% in 1980 (Linz et al. 1983) and 69% (gross dry weight) for our study. In contrast, comparisons with our data revealed that adult male yellow-headed blackbirds collected from noncrop habitats in Benson County during August 1987 consumed approximately twice as much sunflower (Twedt et al. 1991). Benson County in 1987 had 14% of its cropped land planted in sunflower, 40% more than in 1989. The increased availability of sunflower in 1987 or the effects on food availabilities from the late-1980s drought could account for the variability between years in yellow-headed blackbird diets.

Sunflower Habitat

During August, yellow-headed blackbirds had a more diverse diet than red-winged blackbirds and common grackles, which both fed almost exclusively on sunflower during August and September. Only in October did sunflower consumption differ between the two species; during October, red-winged blackbirds increased their weed seed consumption to 30%, while common grackles avoided weed seeds. As the availability of standing sunflower began to decrease, alternate foods were probably being sought, thus causing a change in the red-winged blackbird's diet. Furthermore, the hardening of the fibrous hulls of the matured sunflower achenes may have decreased the shelling efficiency of the smaller-billed red-winged blackbirds, causing a shift in food use (Mah and Nuechterlein 1991). The lack of weed seeds in the diet of common grackles may be related to the

energetic inefficiency of such relatively large birds (>100 g) pursuing small-sized and often widely-spaced foods. In the presence of corn, Dolbeer et al. (1978) noted that common grackles rarely fed on weed seeds.

The high frequencies of occurrence of insects found in red-winged blackbirds and common grackles in September were probably the result of an infestation of sunflower seed weevils (*Smicronyx* spp.) in Benson County (Twedt et al. 1991). Incidental ingestion of the larval weevils was more likely than a purposeful preying upon these insects, as the larvae bore into the achenes and are probably not visible from the outside (Linz et al. 1984).

Because of its abundant Class IV wetlands and sunflower fields, North Dakota will continue to have large breeding and transient populations of blackbirds. The yellow-headed blackbird's more varied diet and early migration from the sunflower-growing region probably make this species the least likely of the three most abundant blackbird species to cause a significant economic impact to the sunflower producer.

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